

CLAIMS

What is claimed is:

1 1. A method for providing antialiasing of a graphical image on a display, the
2 graphical image generated from data describing at least one object, the display including a
3 plurality of pixels, the at least one object including a plurality of fragments, a portion of the
4 plurality of fragments intersecting a pixel of the plurality of pixels, each of the plurality of
5 fragments including an indication of a portion of a corresponding pixel that is intersected,
6 the method comprising the steps of:

7 (a) providing at least one active region for the pixel, each of the at least one
8 active region intersecting a first portion of the pixel;
9 (b) providing at least one new region, a first portion of the at least one new
10 region indicating where in the pixel the at least one active region and the fragment intersect,
11 a second portion of the at least one new region indicating where in the pixel the at least one
12 active region and the fragment do not intersect; and
13 (c) blending a portion of the fragment in a second portion of the pixel
14 corresponding to the first portion of the at least one new region.

1 2. The method of claim 1 further comprising the steps of:
2 (d) updating the at least one active region to be the at least one new region;
3 (e) repeating steps (b) through (d) for each remaining fragment in the portion of
4 the plurality of fragments; and

(f) providing antialiased data for the pixel based on a second portion of the plurality of fragments that have been blended.

3. The method of claim 2 further comprising the step of:

(g) repeating steps (a) through (f) for each of the plurality of pixels.

4. The method of claim 1 wherein for each fragment the indication of the portion of the corresponding pixel that is intersected further includes a coverage mask, and wherein the new region providing step (b) further includes the step of:

(b1) intersecting the coverage mask for the fragment with each of the at least one active region to provide an intersection mask for each of the at least one active region.

5. The method of claim 4 wherein for each of the at least one active regions, the new region providing step (b) further includes the steps of:

(b2) updating an active region if the active region has an intersection mask that covers the active region; and

(b3) splitting the active region into a first new region and a second new region if the active region is not the same as the intersection mask, the first new region corresponding to the intersection mask and being part of the first portion of the at least one new region, the second new region being part of the second portion of the at least one new region.

6. The method of claim 5 wherein the blending step (c) further includes the step of:

3 (c) for each of the at least one active region, blending the portion of the fragment
4 in a second portion of the pixel corresponding to the intersection mask.

1 7. The method of claim 1 wherein each of the plurality of pixels further includes a
2 plurality of subpixels, wherein the first portion of the at least one new region indicates a first
3 portion of the plurality of subpixels in which each of the at least one active region and the
4 fragment intersect, wherein the second portion of the at least one new region indicates a second
5 portion of the plurality of subpixels in which each of the at least one active region and the
6 fragment do not intersect.

1 8. The method of claim 1 wherein each of the plurality of fragments further
2 includes a color, and wherein blending step (c) further includes the step of:

(c1) blending the color of the fragment in the first portion of the at least one new region.

10. The method of claim 1 wherein the at least one new region includes a plurality of new regions, wherein the first portion of the at least one new region includes at least one of the plurality of new regions, and wherein the second portion of the at least one new region includes at least one remaining region of the plurality of new regions.

1 11. A method for providing antialiasing of a graphical image on a display, the
2 graphical image provided from data describing at least one object, the display including a
3 plurality of pixels, the at least one object including a plurality of fragments, a portion of the
4 plurality of fragments intersecting a pixel of the plurality of pixels, each of the plurality of
5 fragments including a coverage mask indicating of a portion of a corresponding pixel that is
6 intersected, the method comprising the steps of:

7 (a) providing at least one active region for the pixel, each of the at least one
8 active region intersecting a first portion of the pixel;

9 (b) intersecting the coverage mask for the fragment with each of the at least one
10 active region to provide an intersection mask for each of the at least one active region.

11 (c) for each of the at least one active region, updating an active region of the at
12 least one active region if the intersection mask is the same as the active region;

13 (d) for each of the at least one active region that is not the same as the intersection
14 mask, splitting the active region into a first new region and a second new region, the first new
15 region being the intersection mask and the second new region being a complement of the
16 intersection mask, the first new region being added to the at least one active region and the
17 second new region an update of the active region;

18 (e) blending a portion of the fragment in a second portion of the pixel
19 corresponding to the intersection mask for each of the at least one active region; and

20 (f) repeating steps (b) through (e) for each of the plurality of fragments
21 intersecting the pixel.

1 12. A system for providing antialiasing of a graphical image from data describing

2 at least one object, the at least one object including a plurality of fragments, the system
3 comprising:

4 a display including a plurality of pixels, each of the plurality of pixels including a
5 number of subpixels;

6 means coupled to the display for providing a plurality of fragments for the at least
7 one object, the plurality of fragments intersecting the plurality of pixels, each of the plurality
8 of fragments including an indication of a portion of a corresponding pixel that is intersected;

9 an antialiasing unit, coupled with the display, for providing antialiasing of each of
10 the plurality of fragments based on the indication of the extent a corresponding pixel is
11 intersected, the antialiasing unit further including

12 an accumulator for storing data relating to the pixel;

13 a region generator coupled with the accumulator for indicating at least one active
14 region for the pixel and at least one new region, each of the at least one active region
15 intersecting a portion of the pixel, the at least one new region being based on an intersection
16 between the at least one active region and the fragment, a first portion of the at least one new
17 region indicating where in the pixel the at least one active region and the fragment intersect,
18 a second portion of the at least one new region indicating where in the pixel the at least one
19 active region and the fragment do not intersect, the region generator indicating the first
20 portion of the at least one new region to be blended; and

21 a blending unit coupled with the accumulator and the region providing, the blending
22 unit blending a portion of the fragment in the first portion of the at least one new region in
23 the fragment.

1 13. The system of claim 12 wherein a number of the at least one blending unit is
2 less than the number of subpixels.

1 14. The system of claim 12 wherein the at least one blending unit further includes
2 a single blending unit.

1 15. The system of claim 12 wherein the region generator further include:
2 the region list for indicating the at least one active region for the pixel;
3 the intersection generator coupled with the region list determining at least one new
4 region for the at least one active region and providing the region list with the at least one
5 new region.

1 16. A computer-readable medium containing a program for antialiasing a
2 graphical image on a display, the graphical image provided from data describing at least one
3 object, the display including a plurality of pixels, the at least one object including a plurality
4 of fragments, a portion of the plurality of fragments intersecting a pixel of the plurality of
5 pixels, each of the plurality of fragments including an indication of a portion of a
6 corresponding pixel that is intersected, the program including instructions for:

7 (a) providing at least one active region for the pixel, the at least one active region
8 intersecting a first portion of the pixel;

9 (b) providing at least one new region, a first portion of the at least one new
10 region indicating where in the pixel the at least one active region and the fragment intersect,
11 a second portion of the at least one new region indicating where in the pixel the at least one

active region and the fragment do not intersect; and

(c) blending a portion of the fragment in a second portion of the pixel corresponding to the first portion of the at least one new region.

17. The computer-readable medium of claim 16 wherein for each fragment the indication of the portion of the corresponding pixel that is intersected further includes a coverage mask, and wherein for each of the at least one active region, the new region providing step instructions (b) further includes instructions for:

(b1) intersecting the coverage mask for the fragment with an one active region to provide an intersection mask for the active region;

(b2) updating the active region if the active region has an intersection mask that covers the first active region; and

(b3) splitting the active region into a first new region and a second new region if the active region is not the same as the intersection mask, the second new region corresponding to the intersection mask and being part of the first portion of the at least one new region, the second new region being part of the second portion of the at least one new region.

18. The computer-readable medium of claim 16 wherein each of the plurality of pixels further includes a plurality of subpixels, wherein the first portion of the at least one new region indicates a first portion of the plurality of subpixels in which each of the at least one active region and the fragment intersect, wherein the second portion of the at least one new region indicates a second portion of the plurality of subpixels in which each of the at least one active region and the fragment do not intersect.

1 19. The computer-readable medium of claim 16 wherein the at least one new
2 region includes a single new region.

1 20. The computer-readable medium of claim 16 wherein the at least one new
2 region includes a plurality of new regions, wherein the first portion of the at least one new
3 region includes at least one of the plurality of new regions, and wherein the second portion
4 of the at least one new region includes at least one remaining region of the plurality of new
5 regions.

1 21. A computer-readable medium containing a program for providing antialiasing
2 of a graphical image on a display, the graphical image being provided from data describing
3 at least one object, the display including a plurality of pixels, the at least one object
4 including a plurality of fragments, a portion of the plurality of fragments intersecting a pixel
5 of the plurality of pixels, each of the plurality of fragments including a coverage mask
6 indicating of a portion of a corresponding pixel that is intersected, the program including
7 instructions for:

- 8 (a) providing at least one active region for the pixel, each of the at least one
9 active region intersecting a first portion of the pixel;
- 10 (b) intersecting the coverage mask for the fragment with each of the at least one
11 active region to provide an intersection mask for each of the at least one active region.
- 12 (c) for each of the at least one active region, updating an active region of the at
13 least one active region if the intersection mask is the same as the active region;
- 14 (d) for each of the at least one active region that is not the same as the intersection

15 mask, splitting the active region into a first new active region and a second new region, the first
16 new region being the intersection mask and the second new region being a complement of the
17 intersection mask;

18 (e) blending a portion of the fragment in a second portion of the pixel
19 corresponding to the intersection mask for each of the at least one active region; and
20 (f) repeating steps (b) through (e) for each of the plurality of fragments
21 intersecting the pixel.